

MM MM TTTTTTTTTT HH HH CCCCCCCC SSSSSSSS IIIII NN NN CCCCCCCC 000000
MM MM TTTTTTTTTT HH HH CCCCCCCC SSSSSSSS IIIII NN NN CCCCCCCC 000000
MMMM Mmmm TT HH HH CC SS SS IIIII NN NN CC 00 00
MMMM Mmmm TT HH HH CC SS SS IIIII NN NN CC 00 00
MM MM MM TT HH HH CC SS SS IIIII NN NN CC 00 00
MM MM MM TT HH HH CC SS SS IIIII NN NN CC 00 00
MM MM TT HH HH CC SSSSSS IIIII NN NN CC 00 00
MM MM TT HH HH CC SSSSSS IIIII NN NN CC 00 00
MM MM TT HH HH CC SS SS IIIII NN NN CC 00 00
MM MM TT HH HH CC SS SS IIIII NN NN CC 00 00
MM MM TT HH HH CC SSSSSS IIIII NN NN CC 00 00
MM MM TT HH HH CC SSSSSS IIIII NN NN CC 00 00
MM MM TT HH HH CC SSSSSS IIIII NN NN CC 00 00
MM MM TT HH HH CC SSSSSS IIIII NN NN CC 00 00
MM MM TT HH HH CCCCCCCC SSSSSSSS IIIII NN NN CCCCCCCC 000000
MM MM TT HH HH CCCCCCCC SSSSSSSS IIIII NN NN CCCCCCCC 000000
LL IIIII SSSSSSSS
LL IIIII SSSSSSSS
LL SS SS
LLLLLLLLLL IIIII SSSSSSSS
LLLLLLLLLL IIIII SSSSSSSS

(2)	50	HISTORY	: Detailed Current Edit History
(3)	59	DECLARATIONS	
(4)	87	MTH\$CSIN	- COMPLEX SINE
(5)	133	MTH\$CCOS	- COMPLEX COSINE
(6)	181	WORKER	- do all the work

0000 1 .TITLE MTHSCSINCOS COMPLEX SINE AND COSINE
0000 2 .IDENT /1-002/ ; File: MTHCSINCO.MAR
0000 3
0000 4
0000 5 *****
0000 6 *
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0000 24 *
0000 25 *
0000 26 *****
0000 27
0000 28
0000 29 .FACILITY: MATH LIBRARY
0000 30 ++
0000 31 .ABSTRACT:
0000 32 Return the SINE of a complex number
0000 33 Return the COSINE of a complex number
0000 34
0000 35
0000 36 --
0000 37
0000 38 .VERSION: 0
0000 39
0000 40 .HISTORY:
0000 41
0000 42 .AUTHOR:
0000 43 Jonathan M. Taylor, 19-JUL-77: Version 0
0000 44
0000 45 .MODIFIED BY:
0000 46
0000 47
0000 48

MTH\$CSINCO\$
1-002

COMPLEX SINE AND COSINE N 10
HISTORY ; Detailed Current Edit History 16-SEP-1984 01:12:16 VAX/VMS Macro V04-00
6-SEP-1984 11:21:26 [MTHRTL.SRC]MTHCSINCO.MAR;1 Page 2 (2)

0000 50 .SBTTL HISTORY ; Detailed Current Edit History
0000 51
0000 52
0000 53 : Edit History for Version 0 of MTH\$CSINCO
0000 54
0000 55 : 1-001 - Update version number and copyright notice. The last edit
0000 56 : 1-002 - Add " " to the PSECT directive. JBS 21-DEC-78
0000 57 : number in version 0 was 3. JBS 16-NOV-78

```
0000 59 .SBTTL DECLARATIONS
0000 60
0000 61 ; INCLUDE FILES:
0000 62 ; OERR.MAR
0000 63
0000 64
0000 65 ; EXTERNAL SYMBOLS:
0000 66 ; .GLOBL MTH$SIN_R4
0000 67 ; .GLOBL MTH$COS_R4
0000 68 ; .GLOBL MTH$EXP_R4
0000 69
0000 70
0000 71 ; MACROS:
0000 72 ; NONE
0000 73
0000 74
0000 75 ; PSECT DECLARATIONS:
0000 76 ; .PSECT _MTH$CODE PIC, SHR, LONG, EXE, NOWRT
0000 77
0000 78
0000 79 ; EQUATED SYMBOLS:
0000 80 ; argadr = 4 ; offset from AP of arg addr
0000 81
0000 82
0000 83 ; OWN STORAGE:
0000 84 ; NONE
0000 85
```

```

0000 87 .SBTTL MTH$CSIN - COMPLEX SINE
0000 88
0000 89 ++
0000 90 : FUNCTIONAL DESCRIPTION:
0000 91
0000 92 MTH$CSIN computes the SINE of a COMPLEX number (r, i) as
0000 93
0000 94 result = (SIN(r) * COSH(i), COS(r) * SINH(i))
0000 95
0000 96 : CALLING SEQUENCE:
0000 97 Sine.wfc.v = MTH$CSIN(arg.rfc.r)
0000 98
0000 99
0000 100 : INPUT PARAMETERS:
0000 101 The one input parameter is the address of a COMPLEX number (r, i),
0000 102 where r and i are both single-precision floating point values.
0000 103
0000 104 : IMPLICIT INPUTS:
0000 105 NONE
0000 106
0000 107 : OUTPUT PARAMETERS:
0000 108 NONE
0000 109
0000 110 : IMPLICIT OUTPUTS:
0000 111 NONE
0000 112
0000 113 : COMPLETION CODES:
0000 114 NONE
0000 115
0000 116 : SIDE EFFECTS:
0000 117 Signals: Reserved Operand if r or i are invalid (-0.0)
0000 118 MTH$ SINSIGLOS if |r| > 2*PI*2**31.
0000 119 Floating Overflow if i > 88.028.
0000 120
0000 121 --
0000 122
0000 123
0000 124 ENTRY MTH$CSIN, ^M<R2,R3,R4,R5,R6,R7>
0000 125 JSB WORKER ; R0 = SIN(r)
0000 126 ; R1 = COS(r)
0000 127 ; R2 = SINH(i)
0000 128 ; R3 = COSH(i)
0000 129 ; R0 = SIN(r) * COSH(i)
0000 130 ; R1 = COS(r) * SINH(i)
0000 131 MULF R3, R0
0000 132 MULF R2, R1
0000 133 RET

```

00000025'EF 00FC 16
50 53 44 0008
51 52 44 000B
04 000E

000F 133 .SBTTL MTH\$CCOS - COMPLEX COSINE
 000F 134
 000F 135 ++
 000F 136 FUNCTIONAL DESCRIPTION:
 000F 137
 000F 138 MTH\$CCOS computes the COSINE of COMPLEX number (r, i) as follows:
 000F 139
 000F 140 result = (COS(r) * COSH(i), -SIN(r) * SINH(-i))
 000F 141
 000F 142 CALLING SEQUENCE:
 000F 143 Cosine.wfc.v = MTH\$CCOS (arg.rfc.r)
 000F 144
 000F 145
 000F 146 INPUT PARAMETERS:
 000F 147 The one input parameter is the address of a COMPLEX number (r, i),
 000F 148 where r and i are both single-precision floating point values.
 000F 149
 000F 150 IMPLICIT INPUTS:
 000F 151 NONE
 000F 152
 000F 153 OUTPUT PARAMETERS:
 000F 154 NONE
 000F 155
 000F 156 IMPLICIT OUTPUTS:
 000F 157 NONE
 000F 158
 000F 159 COMPLETION CODES:
 000F 160 NONE
 000F 161
 000F 162 SIDE EFFECTS:
 000F 163 Signals: Reserved Operand if r or i are invalid (-0.0)
 000F 164 MTH\$ SINSIGLOS if $|r| > 2\pi \cdot 2^{31}$.
 000F 165 Floating Overflow if i > 88.028.
 000F 166
 000F 167 --
 000F 168
 000F 169

00000025'EF	00FC	000F 170 .ENTRY MTH\$CCOS,	^M<R2,R3,R4,R5,R6,R7>
	16	0011 171 JSB WORKER	: R0 = SIN(r)
		0017 172	: R1 = COS(r)
		0017 173	: R2 = SINH(i)
		0017 174	: R3 = COSH(i)
51	53	51 44 0017 175 MULF R1, R3	: R3 = COS(r) * COSH(i)
	50	50 52 001A 176 MNEG F R0, R0	: R0 = -SIN(r)
	52	50 45 001D 177 MULF3 R0, R2, R1	: R1 = -SIN(r) * SINH(i)
	50	53 D0 0021 178 MOVL R3, R0	: R0 = COS(r) * COSH(i)
	04 0024 179 RET		

```

0025 181 .SBTTL WORKER - do all the work
0025 182
0025 183 :+
0025 184 : Setup error handler
0025 185 : Compute:
0025 186 :     R0 = SIN(r)
0025 187 :     R1 = COS(r)
0025 188 :     R2 = SINH(i)
0025 189 :     R3 = COSH(i)
0025 190 :-
0025 191
0025 192 WORKER:
0025 193 MTH$FLAG_JACKET ; set up error handler
0025
0025     MOVAB G^MTH$JACKET_HND, (FP)
0025 ; set handler address to jacket
0025 ; handler
0025
0025     50 04 AC D0 002C 194 MOVL argadr(AP), R0 ; R0 -> (r, i)
0025     50 04 A0 50 0030 195 MOVF 4(R0), R0 ; R0 = i
0025 00000000'EF 16 0034 196 JSB MTH$EXP_R4 ; R0 = EXP(i)
0025 51 08 50 47 003A 197 DIVF3 R0, #1.0, R1 ; R1 = EXP(-i)
0025
0025     55 50 51 43 003E 198 SUBF3 R1, R0, R5 ; R5 = EXP(i) - EXP(-i)
0025     55 00 44 0042 200 MULF #0.5, R5 ; R5 = (EXP(i) - EXP(-i))/2
0025
0025     56 50 51 41 0045 201 ADDF3 R1, R0, R6 ; R6 = EXP(i) + EXP(-i)
0025     56 00 44 0049 202 MULF #0.5, R6 ; R6 = (EXP(i) + EXP(-i))/2
0025
0025     50 04 BC 50 004C 203 MOVF aargadr(AP), R0 ; R0 = r
0025 00000000'EF 16 0050 204 JSB MTH$COS_R4 ; R0 = COS(r)
0025 57 50 D0 0056 205 MOVL R0, R7 ; R7 = COS(r)
0025
0025     50 04 BC 50 0059 206 MOVF aargadr(AP), R0 ; R0 = r
0025 00000000'EF 16 005D 207 JSB MTH$SIN_R4 ; R0 = SIN(r)
0025
0025     51 57 D0 0063 208 MOVL R7, R1 ; R1 = COS(r)
0025 52 55 D0 0066 209 MOVL R5, R2 ; R2 = SINH(i)
0025 53 56 D0 0069 210 MOVL R6, R3 ; R3 = COSH(i)
0025
0025     05 006C 211
0025     006D 212
0025     006D 213
0025     006D 214
0025     006C 215
0025     006D 216
0025     006D 217
0025     006D 218
0025     006D 219
0025     006D 220
0025
0025     .END

```

MTH\$CSINCO\$
Symbol table

COMPLEX SINE AND COSINE

F 11

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(6)

ARGADR	=	00000004
MTH\$S\$JACKET_MND	*****	X 01
MTH\$CCOS	0000000F	RG 01
MTH\$COS_R4	*****	G 00
MTH\$CSIN	00000000	RG 01
MTH\$EXP_R4	*****	G 00
MTH\$SIN_R4	*****	G 00
WORKER	00000025	R 01

! Psect synopsis !

PSECT name

PSECT name	Allocation	PSECT No.	Attributes
. ABS	00000000	(0.) 00	NOPIC USR CON ABS
MTH\$CODE	0000006D	(109.) 01	PIC USR CON REL

! Performance indicators !

Phase

Phase	Page faults	CPU Time	Elapsed Time
Initialization	33	00:00:00.09	00:00:01.38
Command processing	126	00:00:00.60	00:00:03.69
Pass 1	84	00:00:00.72	00:00:02.16
Symbol table sort	0	00:00:00.00	00:00:00.00
Pass 2	51	00:00:00.59	00:00:01.94
Symbol table output	2	00:00:00.01	00:00:00.37
Psect synopsis output	2	00:00:00.02	00:00:00.01
Cross-reference output	0	00:00:00.00	00:00:00.00
Assembler run totals	300	00:00:02.06	00:00:09.56

The working set limit was 900 pages.

3332 bytes (7 pages) of virtual memory were used to buffer the intermediate code.

There were 10 pages of symbol table space allocated to hold 8 non-local and 0 local symbols.

280 source lines were read in Pass 1, producing 14 object records in Pass 2.

1 page of virtual memory was used to define 1 macro.

! Macro library statistics !

Macro library name

\$_255\$DUA28:[SYSLIB]STARLET.MLB;2

0 GETS were required to define 0 macros.

There were no errors, warnings or information messages.

MACRO/ENABLE=SUPPRESSION/DISABLE=(GLOBAL,TRACEBACK)/LIS=LIS\$:_MTHCSINCO/OBJ=OBJ\$:_MTHCSINCO MSRC\$:_MTHJACKET/UPDATE=(ENH\$:_MTHJACKET)+MS

MTI
2-

0258 AH-BT13A-SE
VAX/VMS V4.0

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